

Basewide Energy Systems Plan

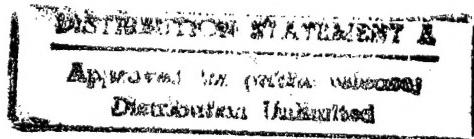
19971023 134

**Executive Summary
Final Report**

Fort Jackson, South Carolina

January 1983

Prepared For
MOBILE DISTRICT CORPS OF ENGINEERS
MOBILE, ALABAMA
CONTRACT DACA01-77-C-0094



Prepared By
BLACK & VEATCH
CONSULTING ENGINEERS
KANSAS CITY, MISSOURI

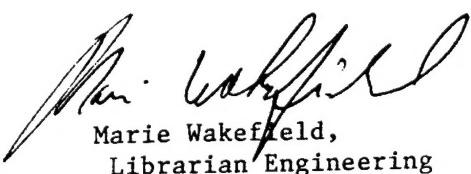


DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

REPLY TO
ATTENTION OF: TR-I Library

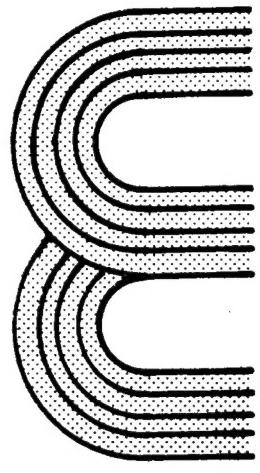
17 Sep 1997

Based on SOW, these Energy Studies are unclassified/unlimited.
Distribution A. Approved for public release.



A handwritten signature in black ink, appearing to read "Marie Wakefield".

Marie Wakefield,
Librarian Engineering



Basewide Energy Systems Plan

Executive Summary Final Report

Fort Jackson, South Carolina

January 1983

Prepared For
MOBILE DISTRICT CORPS OF ENGINEERS
MOBILE, ALABAMA
CONTRACT DACA01-77-C-0094

DMC QUALITY INSPECTED
Prepared By
BLACK & VEATCH
CONSULTING ENGINEERS
KANSAS CITY, MISSOURI

EXECUTIVE SUMMARY - INCREMENTS A, B, C, D and E

This is a summary of the results for Increments A, B, C, D and E of the Basewide Energy Systems Plan for Fort Jackson, South Carolina (the results for Increments F and G are summarized on pages 5 and 6). This plan includes analyses and recommendations of energy conservation projects for reduction of the installation's present energy consumption. The installation should be aware that savings figures presented in this summary can only be realized after all projects have been implemented. Black & Veatch has developed projects that would meet the funding requirements for the energy conservation program. Furthermore, the recommended projects provide partial compliance with the energy conservation requirement for the installation as outlined in the Army Facilities Energy Plan. This summary presents data on the following:

- Existing energy consumption
- Source energy reductions due to energy conservation techniques for buildings and their systems
- Application of solar energy to reduce fossil fuel consumption
- Savings utilizing central energy monitoring and control systems (EMCS)
- Use of solid waste as an alternate energy source
- Analysis of Total Energy/Selective Energy (TE/SE) systems

Tables 1 and 2 present information pertaining to the physical descriptions and energy consumption of 49 typical buildings used to verify historical energy consumption in the development of the basewide

energy use model. This model was then utilized as the foundation for energy conservation project analyses and recommendations. Table 3 summarizes the daily personnel occupancy for each typical building. Tables 1, 2 and 3 also provide information which may be used to estimate source energy consumption for similar buildings within the designated groupings (See Appendix A for all tables referenced in this report). The estimated annual source energy consumption for all building types contributing to the basewide annual total of 2,610,664 mega-Btu, consumed during base year 1975, is shown on Figure 1.

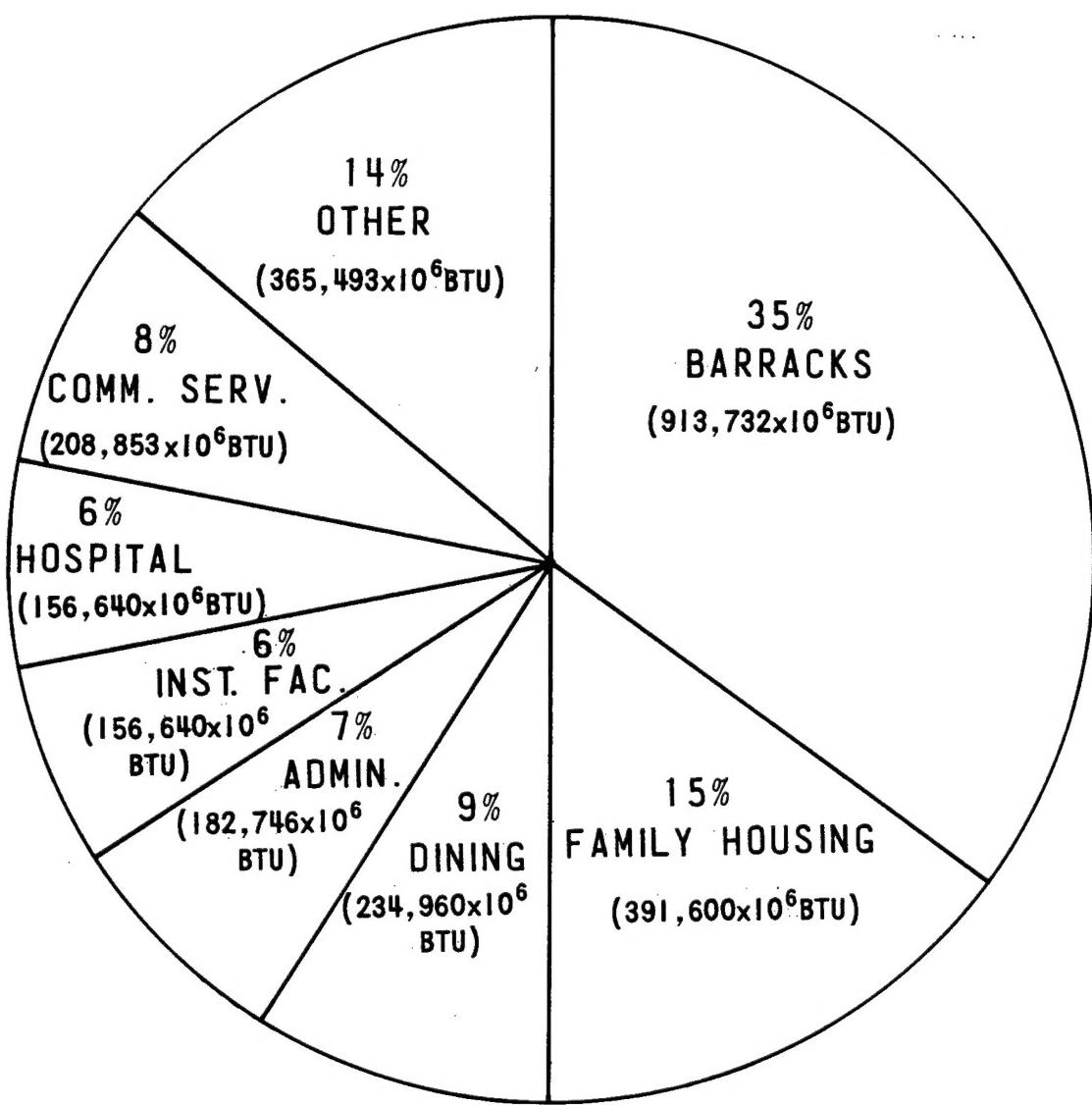
Table 4 indicates the annual source energy consumed by each of the significant building groups used in our basewide energy model. The model was within 10 percent of the historical source energy consumption for FY 1978 shown below.

Yearly Source Energy⁶
Consumption in Btu x 10⁶

1978

Electricity	1,093,555
Natural Gas	1,087,538
Propane Gas	7,135
Fuel Oil No. 1 & 2	201,868
Fuel Oil No. 5 & 6	<u>327,925</u>
TOTAL	2,718,021

The total estimated source energy savings due to implementation of all feasible energy conservation projects developed within the scope of this study is 596,984 mega-Btu/year. These projects consisted of various architectural improvements, and mechanical and electrical system modifications.

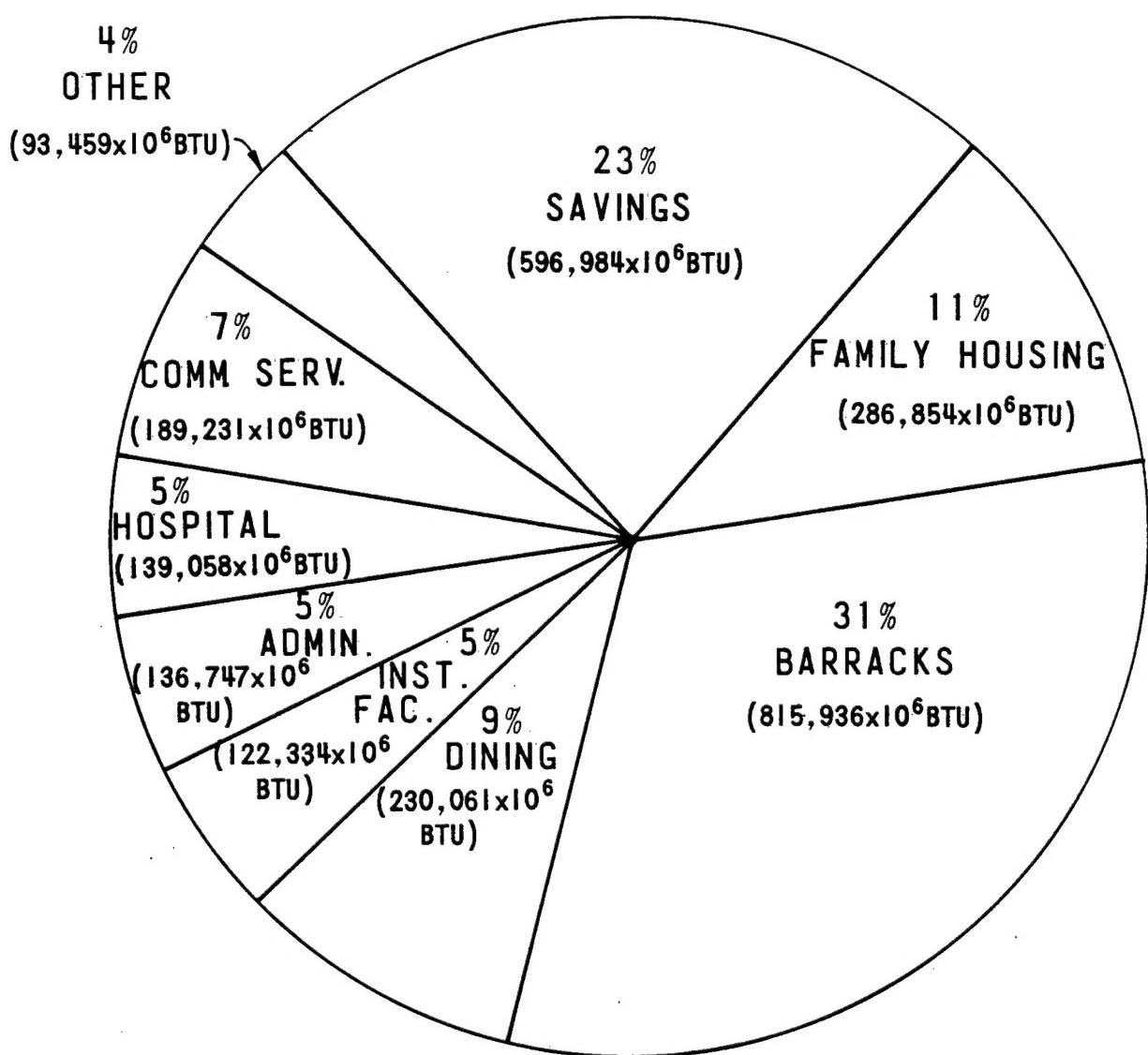


BASEWIDE CONSUMPTION FY '75
(2,610,664x10⁶BTU)

FIGURE 1

Table 5 lists the project number, percent of basewide reduction, and the source energy savings for the indicated building types. Figure 2 illustrates the combined effect of the recommended energy saving improvements, as compared to the FY 1975 source energy expenditure. Our estimates indicate a savings of approximately 23 percent over the base year (1975). Figure 3 illustrates the relative percent reduction for significant bulding groups comprising the 596,984 mega-Btu/year.

A detailed analysis of the projects listed in Table 5 is included in the following reports. Further explanation of the historical energy consumption, basewide energy model, and energy conservation analysis can be found in the Energy Use Survey. Utilizing solar energy, a renewable energy source, to reduce Fort Jackson's dependence on nonrenewable energy sources revealed that the projects investigated would be economically impracticable. Eight concepts were evaluated, and are presented in the Solar Energy Applications and Evaluation. The Energy Monitoring and Control Systems (EMCS) study includes recommendations for additional energy saving programs supplementing the EMCS system under design and the utilization of an FM control system. The additions to the EMCS system under design would result in a savings of 101,568 mega-Btu/year, while the FM control system would save 44,592 mega-Btu/year. The investigation of solid waste for reducing source energy consumption at Fort Jackson resulted in the development of Project No. T-529, which recommends the installation of a solid waste-buring incinerator facility to provide steam to the existing steam distribution system. The proposed plant,



BASEWIDE CONSUMPTION AFTER ENERGY
CONSERVATION PROJECTS
 $(2,013,680 \times 10^6 \text{ BTU})$

FIGURE 2

ALLOCATION OF ENERGY CONSERVATION
PROJECTS SAVINGS

FOR SIGNIFICANT BUILDING GROUPS

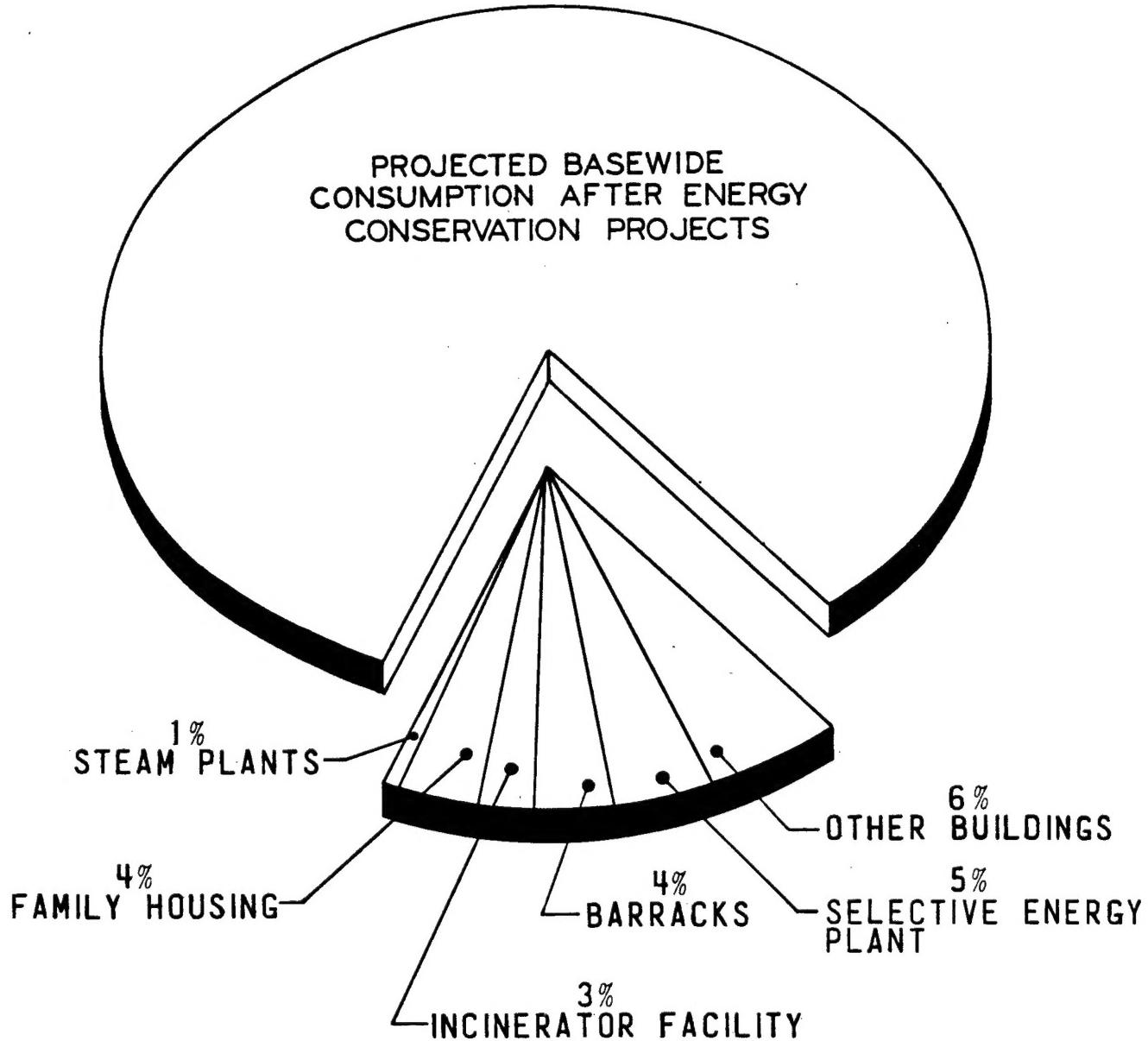


FIGURE 3

to be located near existing Central Energy Plant No. 4333, would provide reduction in both fuel oil and electric consumption totalling 81,113 mega-Btu/year. The details and descriptions of the systems analyzed can be found in the report entitled Total Energy, Selective Energy, and Central Boiler Plants.

The incorporation of a total energy system at this installation would not be recommended. However, a selective energy plant utilizing coal-fired boilers is being recommended. The basewide consumption of fuel oil and natural gas would be reduced by 50 percent, while generating 19 percent of the electrical power required at Fort Jackson. The total annual source energy savings would amount to 5 percent. Detailed descriptions of the TE/SE systems analyzed are included in the Total Energy, Selective Energy, and Central Boiler Plants report.

Table 6 was developed to give a prioritized schedule, in order of fiscal year, for implementing the recommended energy conservation projects.

EXECUTIVE SUMMARY-INCREMENTS F AND G

Increment F - Facilities Engineer Conservation Measures.

Increment G - Maintenance, Repair, and Minor Construction Projects.

This is a summary of the two phases of work that were started after the completion of Increments A, B, C, D, and E in May of 1980. Increments F and G were completed in November, 1982.

The purpose of Increment F of the Basewide Energy Systems Plan is to identify and develop recommendations that can be used by Fort Jackson in preparing its energy management plan. Included are a number of comparatively low cost projects, recommendations for training, and prioritized lists of possible energy conservation measures. Increment G identified maintenance, repair, and minor construction projects for the purpose of conserving energy. These are energy conservation projects that did not meet ECIP criteria or did not fit the ECIP program at the time that the remainder of the study was completed.

The average costs of energy for FY 1981 are given in Table 7. These costs have been used as the basis for determining the dollar savings per year.

Recommended projects developed within the scope of Increments F and G of the study are summarized in Tables 8 and 9 respectively. Projects are prioritized by their E/C ratio. The E/C ratio is defined as the ratio of yearly energy savings in million Btu to the cost estimate in thousands of dollars. Any project showing a payback of 15 years or less is recommended. Cost estimates are representative of April, 1981 prices.

At the request of Fort Jackson, 1391's were prepared for two of the projects developed under Increment G. The first, Hospital Modification, involves converting the existing Dual Duct HVAC system to a Variable Air Volume system. The second project, EMCS Extension, involves installing reset controls at Moncrief Hospital.

Figure 4 is a pie chart showing projected future energy savings due to ECIP projects developed under Increments A, B, C, D, and E and projects developed under Increments F and G.

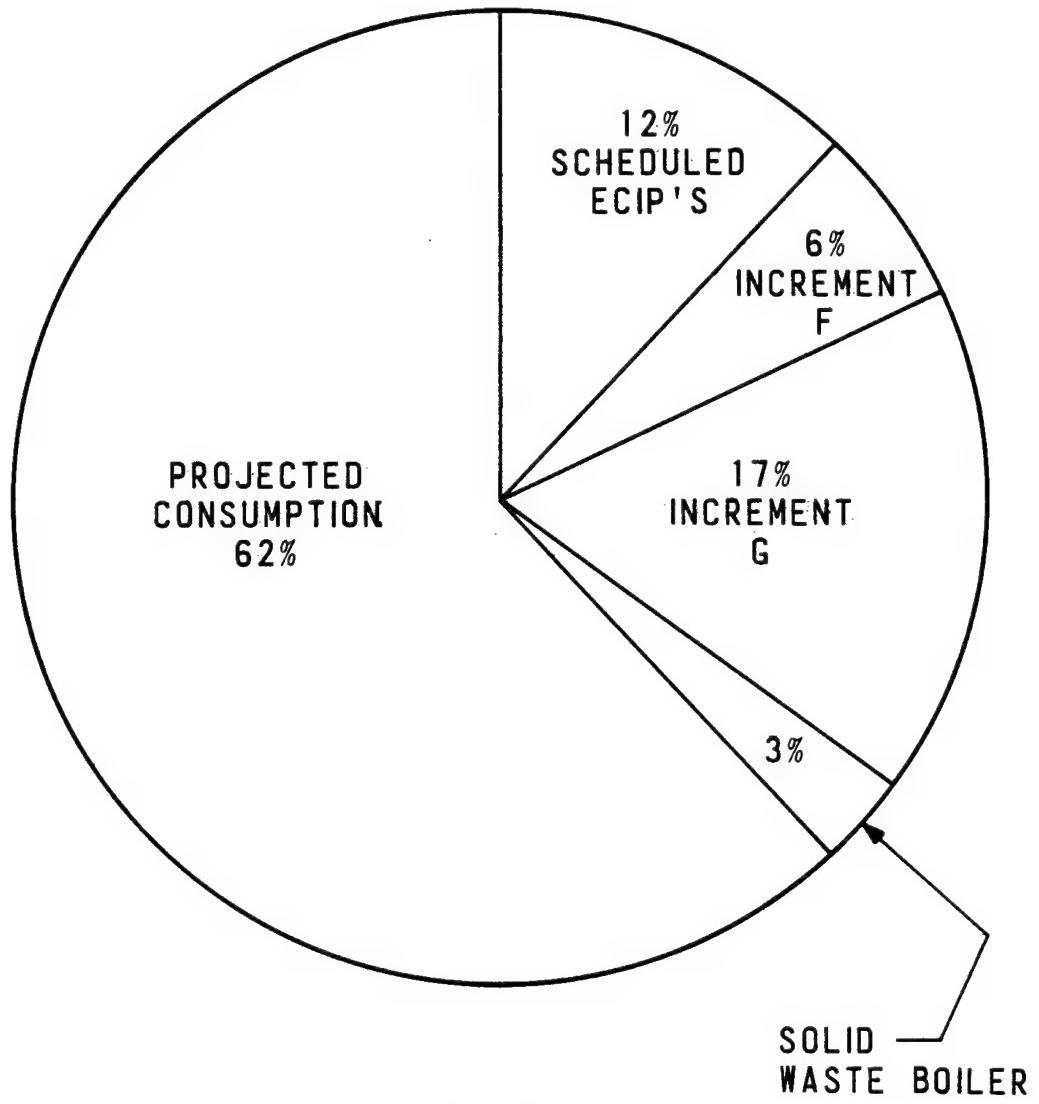
Figure 5 represents a forecast of Fort Jackson's future energy costs. The figure shows how costs could escalate if no energy conservation projects are implemented and what also could happen if all cost effective projects are implemented. The energy conservation projects would more than likely be implemented in three phases:

Phase I - ECIP.

Phase II - Increments F and G and Solid Waste Plant.

Phase III - Selective Energy Plant that would burn coal to produce all the steam requirements and part of the electrical requirements at Fort Jackson.

The curve shows a modest increase in FY86 due to new buildings. The large decrease shown in FY89 is primarily due to using coal, a cheaper fuel, in the Selective Energy Plant.



FORT JACKSON
BASEWIDE CONSUMPTION FY'81
($2,625,074 \times 10^6$ BTU'S)

FIGURE 4

EFFECT OF ESCALATION AND ENERGY
CONSERVATION ON FUEL COST

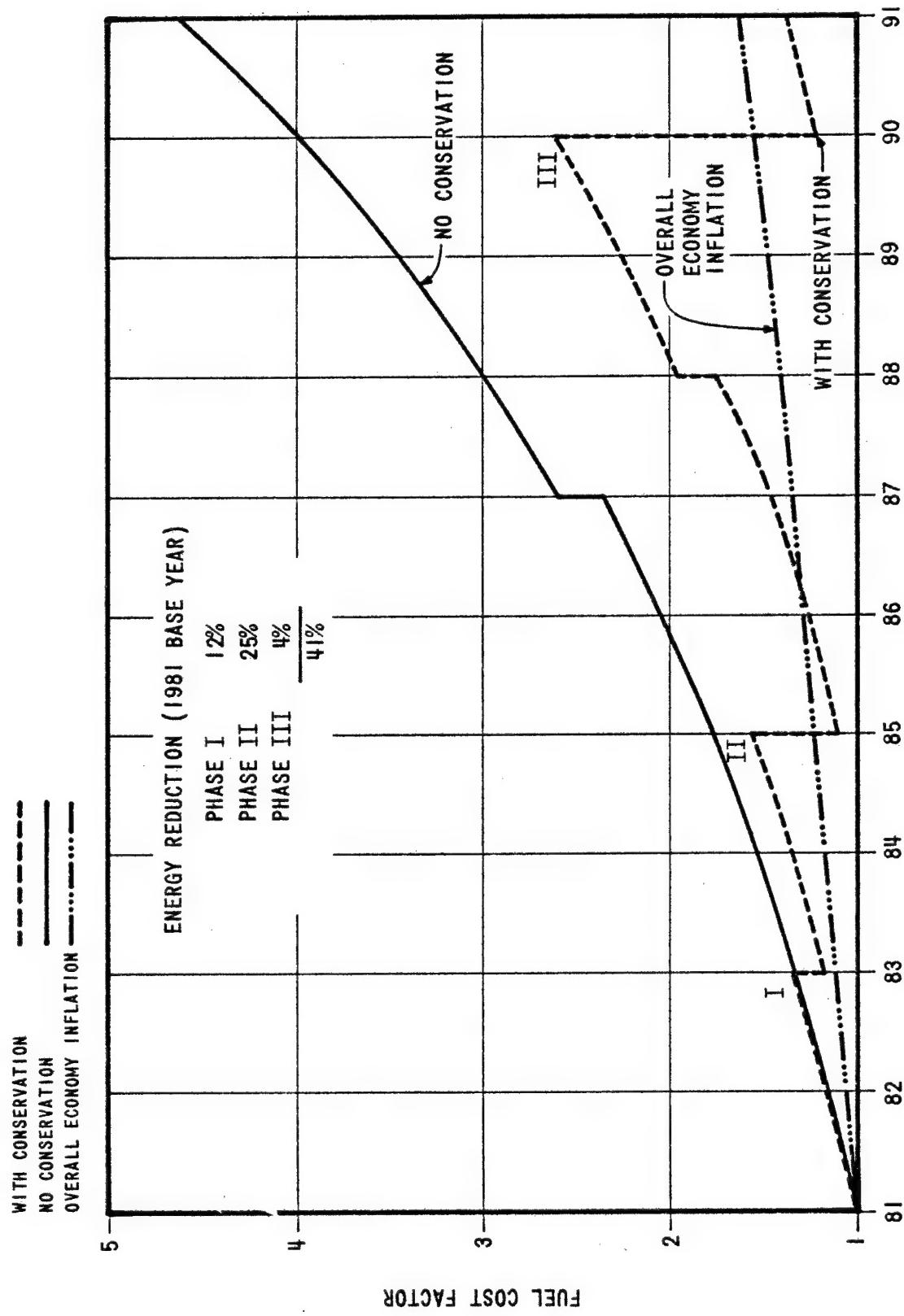


FIGURE 5

APPENDIX A

TABLES

TABLE I
TYPICAL BUILDING CONSTRUCTION DATA
FORT JACKSON

GROUP NO.	BUILDING BLDG. NO.	BUILDING DESCRIPTION	NO. FLS	CONSTRUCTION				'U' VALUES				WINDOW AREA (FT. ²)	COOLING SYSTEM CAP. (TONS)	HEATING SYSTEM CAP. (TONS)	PEAK TRNS LOAD MBH	DOMESTIC HOT WATER CAP. (G.)	
				ROOF	WALL	FLOOR	WINDOW	DOOR	ROOF	WALL	FLOOR						
A-1	2200 SUPPLY/STORAGE	1 BUILT-UP	BRICK & CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.10 .10	.30 -	1.13	.86	.86	3891	13976 CENTRAL PLANT	21 C.E. 2288	HTRW 49.4	197.7	75 ELEC
A-2	4340 BRIGADE HEADQUARTERS	3 BUILT-UP	BRICK & CMU	BASEMENT	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.05 .05	.34 -	1.13	.55	.672	9955 CENTRAL PLANT	1. C.E. 4333	HTRW 1.	130.8	75 GAS	
A-3	5448 ADMINISTRATION	1 SHINGLES	COMPOSITE T & G ON WOOD FRAME	TILE, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	SOLID CORE	.26 .23	.53	1.13	.49	811	6020 CHILLER	21 B.P. 5448	STEAM 87.0	201.6	40 ELEC	
A-4	9702 HEADQUARTERS	1 COMPOSITE	T & G ON WOOD FRAME	TILE, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	SOLID CORE	.26 .23	.53	1.13	.49	240	2284 NONE	-	FURNACE GAS	-	112.0	40 ELEC
B-1	9524 B-O-Q-	1 SHINGLES	COMPOSITE CLAPBOARD ON WOOD FRAME	TILE, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	SOLID CORE	.05 .36	.84	1.13	.49	180	1512 WINDOW UNITS	6 BOILER	OIL 17.1	55.7	66 ELEC	
B-2	9545 BARRACKS	2 SHINGLES	WOOD SIDING & FRAME	WOOD	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.07 .06	.35	1.13	.49	738	5310 NONE	-	FURNACE GAS	-	86.8	85 GAS
B-3	2205 BARRACKS	3 BUILT-UP	BRICK ON CONC. FRAME	TILE, VENTED CRAWL SPACE	SINGLE CLEAR GLASS	STEEL HOLLOW CORE	.04 .04	.39	.52	1.13	.55	4928	41496 CENTRAL PLANT	60 C.E. 2268	HTRW 659.7	229.0	300 HTRW
B-4	5452 BARRACKS/MESS	3 BUILT-UP	CONCRETE BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	STEEL HOLLOW CORE	.07 .27	-	1.13	.55	26207	329165 CENTRAL PLANT	171 C.E. 4533	HTRW 31886	116.2	1000 HTRW	
C-1	9510 THEATRE	1 SHINGLES	WOOD SIDING & FRAME	WOOD, CLOSED CRAWL SPACE	SINGLE CLEAR GLASS	WOOD, SOLID CORE	.27 .19	.37	1.13	.49	62	12139 CHILLER	78 BOILER	GAS 77.6	22.0	NONE	-
C-2	9431 BARBER SHOP	1 SHINGLES	CLAPBOARD ON WOOD FRAME	TILE, VENTED CRAWL SPACE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.05 .36	.38	1.13	.55	231	1150 NONE	-	FURNACE OIL	-	19.2	75 ELEC
C-3	5346 EDUCATION CENTER	1 SHINGLES	CLAPBOARD ON WOOD FRAME	TILE, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD, SOLID CORE	.26 .36	.54	1.13	.49	116	4074 WINDOW UNITS	12 B.P. 5445	STEAM 84.5	198.2	NONE	-
C-4	2009 GYMNASIUM	1 BUILT-UP	CMU	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.07 .51	-	1.13	.55	1676	20266 NONE	-	C.E. 2268	HTRW -	488.5	85 HTRW
C-5	4532 SERVICE STATION	1 BUILT-UP	CONCRETE BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	STEEL HOLLOW CORE	.56 .56	.53	1.13	.55	258	3087 WINDOW UNIT	3 FURNACE	OIL 16.2	127.3	NONE	-
C-6	2395 BOWLING CENTER	1 BUILT-UP	BRICK & CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	STEEL HOLLOW CORE	.2 .3	-	1.13	.55	49	20380 CENTRAL PLANT	39 C.E. 2268	HTRW 36.2	293.7	30 ELEC	
C-7	10762 DAY ROOM	1 COMPOSITE	CLAPBOARD ON WOOD FRAME	TILE, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD, SOLID CORE	.05 .36	.54	1.13	.49	340	1250 NONE	-	FURNACE GAS	-	75.0	40 GAS
C-8	TRANSPORTATION OFFICE	2 SHINGLES	WOOD SIDING & FRAME	WOOD, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	STEEL HOLLOW CORE	.07 .25	.16	1.13	.55	632	4720 WINDOW UNITS	12 BOILER	OIL 16.9	97.6	NONE	-
CS-10	2558 LATRINE	1 WOOD	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD, SOLID CORE	.17 .16	.36	-	1.13	.49	27	358 NONE	-	FURNACE GAS	-	11.9	90 GAS
CS-11	4222 TELEPHONE EXCHANGE BLDG.	1 BUILT-UP	STUCCO ON CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.1 .46	-	1.13	.55	33	3610 PACKAGE UNITS	12 BOILER	HOT WATER 38.0	97.6	NONE	-
D-1	12111 MESS	1 SHINGLES	COMPOSITE	TILE, CLOSED CRAWL SPACE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.05 .32	.23	1.13	.55	397	2360 NONE	-	UNIT HEATERS	-	65.1	100 GAS
D-2	3210 MESS	1 BUILT-UP	BRICK & CMU	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.04 .25	-	1.13	.55	1521	13280 CENTRAL PLANT	51 C.E. 2268	HTRW 56.0	145.3	200 HTRW	
D-3	3630 OFFICER'S MESS	1 BUILT-UP	WOOD SIDING & FRAME	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD, SOLID CORE	.04 .07	-	1.13	.49	1192	20768 CHILLERS	150 BOILER	OIL 59.3	217.0	100 OIL	
E-2	5615 EDUCATION	1 BUILT-UP	CONC. BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.42 .42	.43	-	1.13	.55	37022667 CENTRAL PLANT	99 BOILER	DIL 355.2	937.9	90 OIL	
FN-1	3713 FAMILY HOUSING	2 SHINGLES	BRICK WOOD	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD, SOLID CORE	.08 .08	.09	1.13	.49	1122	9408 COND. UNITS	9 FURNACE	GAS 35.6	91.4	N0 GAS	
FN-2	5724 FAMILY HOUSING	2 SHINGLES	ASPH. SHINGLES	WOOD SIDING & FRAME	SLAB ON GRADE	SINGLE CLEAR GLASS	.07 .07	-	1.13	.49	1182	5488 COND. UNITS	24 FURNACE	GAS 33.7	91.0	40 GAS	
FN-3	6832 FAMILY HOUSING	2 BUILT-UP	BRICK	ASPH. SHINGLES	BASEMENT	SINGLE CLEAR GLASS	.07 .07	.06	1.13	.49	274	2910 COND. UNITS	9 FURNACE	GAS 12.7	38.4	40 GAS	
FN-4	6841 FAMILY HOUSING	1 BUILT-UP	ASPH. SHINGLES	HARDWOOD	SINGLE CLEAR GLASS	WOOD, SOLID CORE	.07 .07	.35	1.13	.49	209	2142 COND. UNITS	9 FURNACE	GAS 18.6	44.9	30 GAS	

1. TYPICAL BUILDING LISTED HAS COOLING, HOWEVER BASEMENT ENERGY MODEL DOES NOT INCLUDE ANY SOURCE ENERGY CONSUMPTION FOR COOLING.

TABLE I (CONT'D)
TYPICAL BUILDING CONSTRUCTION DATA
FORT JACKSON

GROUP NO.	BUILDING BLDG.	DESCRIPTION	CONSTRUCTION						'U' VALUES						WINDOW SQ. FT.	AREA (FT. ²)	COOLING		HEATING		PEAK TRNS. LOAD HIGH	DOMESTIC HOT WATER CAP. (G)
			NO. FLS	WALL	ROOF	FLOOR	WINDOW	DOOR	ROOF	WALL	FLOOR	WINDOW	DOOR	COND. UNITS	COND. UNITS	COND. UNITS	COND. UNITS	SYSTEM (TONS)	FUEL GAIN	LOSS		
FH-5	5716	FAMILY HOUSING	1	ASPHALT SHINGLES	WOOD SIDING & FRAME	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.07	.10	—	1.13 .49	273	2250	6	6	FURNACE	GAS	11.5	40.2	30	GAS
FH-6	9600	FAMILY HOUSING	1	ASPHALT SHINGLES	WOOD SIDING & FRAME	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.07	.12	—	1.13 .49	297	2033	6	6	FURNACE	GAS	7.0	29.0	30	GAS
FH-7	3803	FAMILY HOUSING	2	ASPHALT SHINGLES	WOOD SIDING PANELING	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.05	.07	—	1.13 .49	593	3869	3	3	FURNACE	GAS	16.0	55.2	80	GAS
H-1	6539	OFFICE MOTIVATION	1	COMPOSITE SHINGLES	CLAPBOARD ON WOOD	TILE, CLOSED CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.26	.23	.23	1.13 .49	426	2284	—	—	FURNACE	GAS	—	115.6	40	GAS
H-4	4323	DENTAL CLINIC	1	BUILT-UP	CONCRETE BLOCK, BRICK	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.04	.29	—	1.13 .49	487	11897	CENTRAL PLANT	51	C. E. 4333	HTHW	41.0	171.6	200	ATM
I-1	10404	TRAINING	1	BUILT-UP	CONCRETE BLOCK	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.38	.53	—	1.13 .49	564	3747	COND. UNIT	16	FURNACE	GAS	57.5	136.8	40	GAS
I-3	5462	FIRST-AID CLASSROOM	1	COMPOSITE SHINGLES	CLAPBOARD ON WOOD FRAME	TILE, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.26	.34	1.06 .47	1.13 .49	151	5227	HOME	—	B.P. 5465	STEAM	—	239.2	HOME	—
I-4	2300	INSTRUCTION FACILITY	3	ASPHALT SHINGLES	CLAY TILE	SLAB ON GRADE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.06	.32	—	1.13 .49	1567	67661	CENTRAL PLANT	1.	C. E. 2288	HTHW	1.	862.9	90	HTHW
L-1	1564	LAUNDRY	1	BUILT-UP	CONCRETE BLOCK, BRICK	CLAPBOARD ON WOOD FRAME	CLOSED CRAWL SPACE	SINGLE CLEAR GLASS	.45	.21	.59	1.13 .49	1672	53665	HOME	—	B.P. 1553	STEAM	—	937.6	N/A	STEAM
L-1	9504	LABORATORY	1	BUILT-UP	CONCRETE BLOCK	SLAB ON GRADE	SOLID BASEMENT	SINGLE CLEAR GLASS	.05	.32	—	1.13 .49	442	8782	HOME	—	BOILER	GAS	—	542.9	30	GAS
LA-2	1896	RECEPTION PROCESSING	2	BUILT-UP	CONCRETE BLOCK, BRICK	SLAB ON GRADE	SOLID BASEMENT	SINGLE CLEAR GLASS	.21	.20	—	1.13 .49	5735	13187	CHILLER	380	BOILER	HTHW	\$35.9	603.2	200	STEAM
H-1	6500	MAINTENANCE	1	COMPOSITE SHINGLES	CLAPBOARD ON WOOD FRAME	SLAB ON GRADE	SOLID BASEMENT	SINGLE CLEAR GLASS	.44	.27	—	1.13 .49	231	3108	HOME	—	FURNACE	DIL	—	73.62	HOME	—
H-2	3039	MOTOR REPAIR SHOP	1	CONCRETE SLAB	BRICK & CMU	SLAB ON GRADE	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.26	.36	—	1.13 .49	995	4787	HOME	—	BOILER	HTHW	—	130.8	76	GAS
H-3	1611	TANK REPAIR	1	BUILT-UP	CORRUGATED METAL SIDING	T & G FLOORING	SINGLE CLEAR GLASS	METAL HOLLOW CORE	.27	1.11	.43	1.13 .49	6110	24898	WINDOW UNIT	3	BOILER	DIL	13.1	806.2	76	DIL
R-1	12104	CHAPEL	1	COMPOSITE SHINGLES	CLAPBOARD ON WOOD FRAME	T & G, CLOSED CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.38	.26	.19	1.13 .49	582	3846	COND. UNIT	36	BOILER	GAS	53.0	139.2	30	GAS
R-2	11550	CHAPEL	1	COMPOSITE SHINGLES	CLAPBOARD ON WOOD FRAME	T & G, CLOSED CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.38	.26	.19	1.13 .49	600	3200	HOME	—	FURNACE	DIL	—	111.0	30	DIL
U-2	ALL	ALL BLDGS. IN THE GROUP	—	—	—	—	—	—	NOT APPLICABLE	—	—	9427	—	—	—	—	NOT APPLICABLE	—	—	—	—	
U-3	ALL	ALL BLDGS. IN THE GROUP	—	—	—	—	—	—	NOT APPLICABLE	—	—	3631	—	—	—	—	NOT APPLICABLE	—	—	—	—	
U-4	5485	HEATING & COOLING PLANT	—	—	—	—	—	—	NOT APPLICABLE	—	—	6303	—	—	—	—	NOT APPLICABLE	—	—	—	—	
W-1	2530	WAREHOUSE	1	ASPHALT SHINGLES	CLAPBOARD ON WOOD FRAME	CONCRETE, OPEN CRAWL SPACE	SINGLE CLEAR GLASS	WOOD SOLID CORE	.44	.36	.84	1.13 .49	45	9373	WINDOW UNIT	3	SPACE HEATERS	GAS	26.5	93.4	40	GAS
X	NO UTILITIES	ELECTRIC ONLY	—	INCLUDES OUTDOOR LIGHTING AND AUXILIARIES	—	—	—	—	NOT APPLICABLE	—	—	—	—	—	—	—	NOT APPLICABLE	—	—	—		
Z	ALL BLDG. IN THE GROUP	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		

1. TYPICAL BUILDING LISTED HAS COOLING, HOWEVER BASESIDE ENERGY MODEL DOES NOT INCLUDE ANY SOURCE ENERGY CONSUMPTION FOR COOLING.

TABLE 2
TYPICAL BUILDING ENERGY CONSUMPTION DATA
FORT JACKSON

GROUP NO.	BLDG.	BUILDING DESCRIPTION	ANNUAL ENERGY SOURCE CONSUMPTION BTUx10 ⁶			ELEC'L ENER. CONSUMPTION	BTU x 10 ³ FT ²	
			FUEL	ELEC.	TOTAL	KW PEAK		
A-1	2200	SUPPLY/STORAGE	1369	537	1906	15	46237	146.9
A-2	4340	BRIGADE HEADQUARTERS	564	1507	2071	27	129884	208.0
A-3	5448	ADMINISTRATION	898	691	1589	40	59530	198.1
A-4	9702	HEADQUARTERS	602	185	787	6	16007	344.6
B-1	9524	B.O.Q.	167	201	368	11	17310	243.4
B-2	9545	BARRACKS	1081	103	1184	3	8906	223.0
B-3	2205	BARRACKS	6549	1998	8547	31	172224	206.0
B-4	5422	BARRACKS/MESS	22016	47732	69748	1045	4114870	211.9
CS-1	9510	THEATRE	1257	1471	2728	106	126752	224.7
CS-2	9631	BARBER SHOP	266	42	308	1	3552	267.8
CS-4	5346	EDUCATION CENTER	812	889	1701	36	76607	417.5
CS-5	2009	GYMNASIUM	2034	2491	4525	80	214739	223.1
CS-6	4522	SERVICE STATION	333	461	794	12	39730	257.2
CS-7	2395	BOWLING CENTER	4971	5749	10720	140	495586	526.0
CS-8	10762	DAY ROOM	396	149	545	4	12886	436.0
CS-9	8568	TRANSPORTATION OFFICE	540	486	1026	22	41906	217.4
CS-10	2558	LATRINE	277	25	302	1	2165	843.6
CS-11	4282	TELEPHONE EXCHANGE BLDG.	247	1346	1593	28	116077	437.6
D-1	12111	MESS	250	630	880	35	54347	372.9
D-2	3210	MESS	6365	6426	12791	105	553949	963.2
D-3	3630	OFFICER'S MESS	2047	3638	5685	149	313670	273.5
E-2	5615	PRIMARY EDUCATION	10089	1381	11470	36	119017	506.0
FH-1	3773	FAMILY HOUSING	647	765	1412	19	65984	150.1
FH-2	5724	FAMILY HOUSING	531	754	1285	36	65009	234.1
FH-3	6832	FAMILY HOUSING	342	244	586	10	21057	201.4
FH-4	6841	FAMILY HOUSING	434	229	733	12	25761	342.2

TABLE 2 (CONT'D)
TYPICAL BUILDING ENERGY CONSUMPTION DATA
FORT JACKSON

TABLE 3
BUILDING OCCUPANCY
FORT JACKSON

GROUP NO.	BLDG.	BUILDING DESCRIPTION	NORMAL PEAK POPULATION	OCCUPANCY
A-1	2200	SUPPLY/STORAGE	9	WEEKDAYS - 7:00 A.M. TO 6:00 P.M.
A-2	4340	BRIGADE HEADQUARTERS	40	WEEKDAYS - 7:30 A.M. TO 5:00 P.M.
A-3	5448	ADMINISTRATION	24	WEEKDAYS - 8:00 A.M. TO 5:00 P.M.
A-4	9702	HEADQUARTERS	10	OPEN 24 HOURS
B-1	9524	B.O.Q.	19	OPEN 24 HOURS
B-2	9545	BARRACKS	28	OPEN 24 HOURS
B-3	2205	BARRACKS	290	OPEN 24 HOURS
B-4	5422	BARRACKS/MESS	1200	OPEN 24 HOURS
CS-1	9510	THEATRE	1000	7 DAYS A WEEK - 11:00 TO 11:00 P.M.
CS-2	9631	BARBER SHOP	6	MONDAY THRU SATURDAY - 8:00 A.M. TO 5:00 P.M.
CS-4	5346	EDUCATION CENTER	33	MONDAY THRU THURSDAY - 7:30 A.M. TO 9:15 P.M. FRIDAY - 7:30 A.M. TO 4:15 P.M., SATURDAY - 7:30 A.M. TO 11:30 A.M.
CS-5	2009	GYMNASIUM	700	7 DAYS A WEEK - 8:00 A.M. TO 8:00 P.M.
CS-6	4522	SERVICE STATION	8	WEEKDAYS - 7:30 A.M. TO 7:00 P.M., SATURDAY - 9:00 A.M. TO 6:00 P.M. SUNDAY - 11:00 A.M. TO 5:00 P.M.
CS-7	2395	BOWLING CENTER	360	MONDAY THRU FRIDAY - 8:00 P.M. TO 11:00 P.M. SATURDAY, SUNDAY & HOLIDAYS - 10:00 A.M. TO 11:00 P.M.
CS-8	10762	DAY ROOM	25	WEEKDAYS - 8:30 P.M. TO 10:00 P.M.
CS-9	8568	TRANSPORTATION OFFICE	30	WEEKDAYS - 8:00 A.M. TO 5:00 P.M.
CS-10	2558	LATRINE	15	WEEKDAYS - 6:00 A.M. TO 6:00 P.M.
CS-11	4282	TELEPHONE EXCHANGE BLDG.	10	7 DAYS A WEEK - 7:30 A.M. TO 11:00 P.M.
D-1	12111	MESS	86	WEEKDAYS - 5:00 A.M. TO 7:00 P.M.
D-2	3210	MESS	250	WEEKDAYS - 6:00 A.M. TO 7:00 P.M.
D-3	3630	OFFICER'S MESS	80	7 DAYS A WEEK - 8:00 A.M. TO 1:00 P.M.
E-2	5615	PRIMARY EDUCATION	320	WEEKDAYS - 8:00 A.M. TO 4:00 P.M.
FH-1	3773	FAMILY HOUSING	32	OPEN 24 HOURS
FH-2	5724	FAMILY HOUSING	16	OPEN 24 HOURS
FH-3	6832	FAMILY HOUSING	8	OPEN 24 HOURS
FH-4	6841	FAMILY HOUSING	8	OPEN 24 HOURS
FH-5	5716	FAMILY HOUSING	8	OPEN 24 HOURS
FH-6	3600	FAMILY HOUSING	8	OPEN 24 HOURS
FH-7	3805	FAMILY HOUSING	8	OPEN 24 HOURS
H-1	6549	OFFICE MOTIVATION PLATOON	10	OPEN 24 HOURS
H-4	4323	DENTAL CLINIC	50	WEEKDAYS - 7:30 A.M. TO 4:15 P.M.
I-1	10404	TRAINING	30	WEEKDAYS - 8:00 A.M. TO 5:00 P.M.
I-3	5462	FIRST AID CLASSROOM	30	WEEKDAYS - 8:00 A.M. TO 5:00 P.M.
I-4	2300	INSTRUCTION FACILITY	376	WEEKDAYS - 6:30 A.M. TO 3:30 P.M.
L-1	1561	LAUNDRY	81	WEEKDAYS - 7:30 A.M. TO 4:00 P.M.
LA-1	9504	LABORATORY	15	WEEKDAYS - 7:00 A.M. TO 4:00 P.M.
LA-2	1895	RECEPTION PROCESSING	90	WEEKDAYS - 6:00 A.M. TO 5:00 P.M.

TABLE 3 (CONT'D)
BUILDING OCCUPANCY
FORT JACKSON

TABLE 4
Building Group Source Energy Consumption

Group	Description	Group Sq. Ft.	Total Source Consumption ⁶ Btu's x 10 ⁶
A	Administrative	708,941	178,148
B	Barracks	4,113,791	875,800
CS	Community Service	618,388	202,655
D	Dining	371,309	243,599
E	Education Facilities	64,069	32,460
F	Family Housing	1,716,078	366,282
H	Hospital	530,170	148,062
I	Instruction Facilities	535,602	139,761
L	Laundry	53,565	33,037
LA	Laboratory Facilities	233,217	49,376
M	Maintenance	346,535	45,550
R	Religious Facilities	64,067	14,127
W	Warehouse	535,781	38,355
U-2	Water Treatment	9,427	5,708
U-3	Pump Houses	3,631	18,320
U-4	Boiler Plants	43,880	26,313
X	Buildings with no Utilities	115,555	
Z	Electric Only (includes outdoor lights)	145,766	108,443

**ENERGY CONSERVATION PROJECTS
SOURCE ENERGY SAVINGS**

BUILDING TYPE	ENERGY SAVINGS 'BTUx1,000,000	% BASEWIDE REDUCTION FY'75	PROJECT NUMBER
FAMILY HOUSING	47,466 37,927 19,353 <hr/> 104,746	1.82 1.45 0.74 <hr/> 4.01	T-507 T-521 T-520
BARRACKS	1,420 45,374 40,872 10,130 <hr/> 97,796	.05 1.74 1.57 .39 <hr/> 3.75	T-510 T-509 T-518 T-539
INCINERATOR FACILITY	81,113	3.11	T-529
STEAM PLANTS	26,451	1.01	T-517
SELECTIVE ENERGY PLANT	140,000	5.36	
OTHER BUILDINGS AFFECTED BY ECIP'S	15,883 14,318 25,239 91,438 <hr/> 146,878	.61 0.55 0.97 3.50 <hr/> 5.63	T-510 T-518 T-520 T-539
TOTAL	596,984	22.87	

TABLE 5

ENERGY CONSERVATION PROJECTS DEVELOPED SCHEDULE - FT. JACKSON, SOUTH CAROLINA

PROJECT TITLE	PROJECT NUMBER	RECOMMENDED FISCAL YEAR	COST \$ x 1000	E/C RATIO	ENERGY SAVINGS BTUx1,000,000	YEARS PAYBACK	B/C RATIO
RELAMPING FLUORESCENT FIXTURES	T-510	1980	227	76.4	17,303	1.8	4.5
STORM WINDOWS, WEATHERSTRIP DOORS, AND KITCHEN LIGHTING FIXTURE IN FAMILY HOUSING	T-507	1980	1044	47.9	47,466	6.4	2.8
INSULATED PANELS, STORM WINDOWS, HALL LIGHTING FIXTURES, AND WEATHERSTRIP DOORS IN PERMANENT BARRACKS	T-509	1980	1495	30.4	45,374	8.1	2.3
TOTAL			2766		110,143		
FAMILY HOUSING EQUIPMENT MODIFICATIONS (ECIP)	T-521	1981	1084	36.9	37,927	11.5	1.7
ADJUST FRESH AIR QUANTITIES	T-518	1981	268	205.8	55,190	1.5	12.3
STEAM PLANT MODIFICATIONS	T-517	1981	301	87.9	26,451	3.6	5.5
FM RADIO CONTROL SYSTEM	T-520	1981	600	74.3	44,592	2.4	5.1
TOTAL			2253		164,160		
SOLID WASTE BURNING INCINERATOR FACILITY	T-529	1982	3182	25.5	81,113	22.5	1.1
EMCS EXTENSION	T-539	1982	862	117.8	101,568	2.6	4.9
TOTAL			4044		182,681		
SELECTIVE ENERGY PLANT	1983	27400	N/A		140,000	14.0	1.7
TOTAL		27400			140,000		

TABLE 6

TABLE 7

FY81 Average Energy Costs

Electricity	
Demand	\$6.85/kW
kWh (without demand)	\$.02337/kWh
kWh (including demand)	\$.03702/kWh
Natural Gas	
Firm	\$2.645/mcf
Interruptible	\$3.525/mcf
Combination	\$3.308/mcf
Propane	
Commodity	\$0.6239/gal.
Fuel Oil	
No. 2	\$1.22/gal.
No. 6	\$.87/gal.

$$\frac{10,000 \text{ kWh}}{1,000 \text{ kWh}} \times \frac{1 \text{ gal.}}{95,500 \text{ kWh}} \times \frac{\$1.22}{1 \text{ gal.}}$$

$$\frac{10,000}{95,500} \times \$1.22 =$$

TABLE 8
Summary of Increment F Projects

<u>Project</u>	<u>Location(s)</u>	<u>Energy Savings/Year</u>	<u>Dollar Savings/Year</u>	<u>Payback Years</u>	<u>B/C</u>	<u>E/C</u>	<u>Contract Cost</u>	<u>Material</u>	<u>In-House Cost Manhours</u>	<u>Reference Pages</u>	<u>Narr. Calcs.</u>
<u>Reduction-of-Ventilation Air Quantities</u>	14 Bldgs.	52,674	\$ 243,354	.02	1274.	9,177 \$	5,740 \$	0	A/C Mechanic 265	8	A1
Cycle Pool Pumps	5 pumps	1,135	3,019	.17	122.	2,154	527	270	Electrician 4	35	A163
Chilled Water Supply Modification in Laundry Rooms	5422 and 5482	2,820	13,028	0.2	265.	1,912	1,475	417	A/C Mechanic 40	19	A77
Water Restrictors (Hot)	Per Unit Basis	10.9	62.7	.13	201.0	1,351	8.07	3.70	Laborer .1	32	A137
Receptacle Insulation	Family Housing	20,053	87,967	0.3	74.0	669	29,954	3,943	Laborer 1,149	16	A48
Swimming Pool Cover	Bldg. 3296	2,245	10,372	.4	79.0	568	4,000	-	-	39	A197
Furnace Derating	Family Housing	5,676	26,223	0.4	77.0	555	10,221	0	Heat Shop 383	30	A129
Filter Maintenance	Basewide	11,411	9,535	0.8	18.3	295	38,619	7,707	Laborer 2,080	14	A37
Insulate Water Heaters	Family Housing	3,024	13,971	1.2	25.0	181	16,747	3,964	Laborer 575	38	A189
Reduce Infiltration in Family Housing	Family Housing	41,776	182,982	1.8	14.0	126	332,419	80,425	Laborer 12,064	12	A26
Photocells for Warehouse Exterior Lighting	Warehouses	133	561	2.0	10.7	120	1,109	398	Electrician 21	18	A65
Solar Film (West)	Sq. Ft. Basis	1302	.60	5.6	5.4	39	2.54	--	--	23	A93
Solar Film (Southwest)	Sq. Ft. Basis	.1231	.57	5.9	5.1	37	2.54	--	--	23	A93

TABLE 8
Summary of Increment F Projects
Continued

Project	Location(s)	Energy Savings/Year MMBtu	Payback Years	Contract			In-House Cost Manhours	Reference Pages Narr. Calcs.
				B/C	E/C	Cost Material		
Window Insulation	26 Bldgs.	2,555	11,804	6.2	4.9	35	72,926 32,364	Laborer 2,342 10 A17
Electronic Ignition in Furnaces	Family Housing	8,321	37,875	6.4	4.5	34	242,139 133,214	Heat Shop 2,300 28 A118
Solar Film (East)	Sq. Ft. Basis	.1095	.51	6.6	4.6	33	2.54	--
Solar Film (Southeast)	Sq. Ft. Basis	.1023	.47	7.1	4.2	31	2.54	--
Solar Film (Northwest)	Sq. Ft. Basis	.0961	.44	7.6	3.9	29	2.54	--
Vent Restrictors	Family Housing	3,677	16,988	7.8	3.8	28	133,177 7,866	Heat Shop 5,900 27 A110
Vent Dampers	Family Housing	4,900	22,638	8.0	3.7	27	181,605 72,435	Heat Shop 2,873 25 A101
Solar Film (Northeast)	Sq. Ft. Basis	.0891	.41	8.2	3.7	27	2.54	--
Solar Film (South)	Sq. Ft. Basis	.0829	.38	8.8	3.4	25	2.54	--
Variable Air Volume	Bldg. 3319	563	2,376	11.0	2.0	21	26,300	11,421 A/C Mechanic 405 21 A85
Indoor Swimming Pool Lighting Upgrade	Bldg. 3296	856	11,218	3.1	3.9	20	34,830 20,508	Electrician 192 37 A178
Solar Film (North)	Sq. Ft. Basis	.0588	.27	12.4	2.4	18	2.54	--
Fluorescent Lighting Ballast Replacement	Per Unit Basis	.386	1.63	16.0	1.3	15	26.0	26.0 0 17 A58
Skylights	Bldg. 3296	375	1,013	32.0	0.7	12	32,000 8,413	Laborer 480 41 A210
Water Restrictors (Cold)	Per Unit Basis	0	12.4	0.7	14.0	0	8.07 3.70	Laborer .1 32 A137

TABLE 8
Summary of Increment F Projects
Continued

<u>Project</u>	<u>Location(s)</u>	<u>Energy Savings/Year MMBtu</u>	<u>Dollar Savings/Year</u>	<u>Payback Years</u>	<u>B/C</u>	<u>E/C</u>	<u>Contract Cost</u>	<u>Material</u>	<u>In-House Cost</u>	<u>Manhours</u>	<u>Narr.</u>	<u>Reference Pages</u>	<u>Calcs.</u>
Toilet Tank Dams	Family Housing	0	6,819	1.4	6.6	0	9,355	4,129	Laborer 191		34	A156	
Flush Valve Restrictors	Basewide	0	26,700	0.6	15.0	0	16,604	8,198	Laborer 267		33	A145	
Computer Room Modification	Bldg. 2572	-95	1,180	2.5	2.0	-32	2,938	2,174	A/C Mechanic 32		36	A169	

TABLE 9
Summary of Project Data - Increment G

<u>Project</u>	<u>Location(s)</u>	<u>Energy Savings/Year</u> <u>MMBtu</u>	<u>Dollar Savings/Year</u>	<u>Payback Years</u>	<u>B/C</u>	<u>E/C</u>	<u>Contract Cost</u>	<u>Material</u>	<u>To-House Cost</u>	<u>Manhours</u>	<u>Narr.</u>	<u>Reference Pages</u>	<u>Calcs.</u>
Operating Room Modifications	Moncrief Hospital	4,162	\$19,228	0.13	219.	1,580	\$2,600	-	-	-	35	B-217	
Submersible Pumps for Valve Pits	Building 3300	357	1,724	0.2	164.	1,170	305	\$ 178	Electrician	1.5	23	B-147	
Bulb-Type Thermostats	Basewide	213,334	985,603	0.2	136.	995	214,438	180,720	Electrician	2,050	26	B-164	
Pipe Insulation	111 Buildings	19,816	91,550	0.5	57.	412	48,032	15,465	Insulator	1,124	25	B-155	
Variable Speed Chilled Water Pumping	Bldgs. 1699, 27,169 2288, and 4333	27,169	72,270	1.4	15.4	272	99,960	75,500	Electrician	50	13	B-91	
<hr/>													
EM Control System Expansion													
Automatic Chiller Condenser Tube Cleaning	2 - 700 ton centra-vac	4,777	22,070	2.5	12.5	86	55,556	-	-	-	4	B-1	
Automatic Chiller Condenser Tube Cleaning	2 - 1,165 ton absorption	7,719	35,662	3.5	8.5	61	126,180	-	-	-	4	B-1	
Fluorescent Lighting Load Reduction	Basewide	17,066	141,397	2.1	9.7	57	296,672	157,813	Laborer	2,612	6	B-50	
Automatic Chiller Condenser Tube Cleaning	5 - 700 ton absorption	11,944	55,181	4.0	7.5	54	220,881	-	-	-	4	B-1	
Automatic Chiller Condenser Tube Cleaning	1 - 600 ton absorption	1,988	9,185	4.6	6.5	47	42,675	-	-	-	4	B-1	
Boiler Upgrade	1 Barracks	196	906	4.8	6.2	45	4,390	2,763	Heat Shop	16	11	B-83	

TABLE 9
Summary of Project Data - Increment G
 (Continued)

<u>Project</u>	<u>Location(s)</u>	<u>Energy Savings/Year MBtu</u>	<u>Dollar Savings/Year</u>	<u>Payback Years</u>	<u>B/C</u>	<u>E/C</u>	<u>Contract Cost</u>	<u>Material</u>	<u>In-House Cost</u>	<u>Manhours</u>	<u>Narr.</u>	<u>Pages</u>	<u>Reference Calcs.</u>
Automatic Chiller Condenser Tube Cleaning	1 - 235 ton centra-vac	802	3,705	5.0	6.1	44	18,374	-	-	-	4	B-1	
Hospital Modifications	Bldg. 4500	29,460	\$136,105	4.9	6.1	44	\$667,200	-	-	-	33	B-203	
Variable Speed Hot Water Pumping	Bldgs. 1699, 5,173 2288, and 4333	13,760	8.6	2.5	44	118,494	\$103,488	Electrician	96	15	B-99		
ENCS Extension	Moncrief Hospital	8,403	38,822	5.7	5.3	38	221,000	-	-	-	31	B-191	
Ceiling Fans	26 Buildings	1,737	9,201	6.4	4.9	30	58,700	21,438	Electrician General	900	8	B-68	
Window Reduction	Permanent Barracks and Mess Halls	15,705	72,834	7.5	4.0	29	546,267	288,285	Carpenter	10,519	19	B-118	
Automatic Chiller Condenser Tube Cleaning	1 - 235 ton absorption	802	3,705	8.0	3.7	27	29,767	-	-	-	4	B-1	
Insulate Warehouse Offices	2500 and 3500 Areas	1,376	6,357	9.1	3.3	24	58,035	22,254	Laborer	1,472	17	B-108	
Storm Doors	Family Housing	4,534	20,152	10.5	2.5	21	212,440	115,016	Carpenter	1,149	21	B-131	
Infra-Red Heating	5 Buildings	667	3,082	15.0	2.0	14	46,717	18,178	Heat Shop	924	28	B-176	
Replace Incandescent Lighting with HPS	Hospital Area Per Unit Basis	4.95	13.2	19.1	.9	12	423	269	Electrician	2	22	B-142	